The Impact of Trade Integration and Agglomeration Economies on Tax Interactions : Evidence from OECD Countries

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Abstract

In average, statutory tax rates in OECD countries fell over 34,84% between 1982 and 2005. While the seminal papers on tax competition explain this fall in corporate tax rates by greater capital mobility, we build on the New Economic Geography literature to investigate empirically the impact of trade integration on tax competition. We use the disaggregated Trade and Production Database of the CEPII to build an index of trade phi-ness following the method of Head and Mayer (2004a). Firstly, we show that trade integration matters for the tax policy through two channels: (i) on the one hand trade integration reinforces tax interactions and accelerates the race to the bottom in corporate taxe rates, but (ii) on the other hand trade integration makes it possible for countries to set higher corporate tax rates as it improves their market access. We show that the second effect becomes insignificant when we control for the first one. This indicates that the overall impact of trade integration on corporate tax rates is negative and could explain the negative relationship between trade integration and corporate tax rates that we observed in OECD countries between 1983 and 1999. Secondly, we show that countries do not have the same ability to limit their dependence on other countries' fiscal policy. More precisely, the ability of a country to set a high corporate tax rate increases with its market size and its market access, but decreases with the degree of its government involvement in the wage-setting.

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1 Introduction

Since the early 1980s, the decline in corporate tax rates in developed countries was almost continuous. This trend has contributed to the fear of tax competition, a process according to which governments compete with each other to attract capital inflows by decreasing their corporate tax rates. Among the main global regions, it is in the EU that the KPMG institute recorded the largest decline in the statutory corporate tax rate over the last fourteen years (see appendix A.1.)[1]. Behind this common trend, there are still important fiscal disparities. In 2006, the highest corporate tax rates was observed in the G7 countries whose average tax rate (36.5%) was ten points higher than the average rate of the EU-27 (25.9%). Fiscal disparities are also important within the EU. In 2006, the corporate tax rate of the EU-15 (29.54%) was in average ten points higher then the average tax rate of the new entrants (19.33%). These observations raise two questions we would like to answer to in this paper.

Did greater economic integration contribute to this common trend of fall in corporate taxation? From a theoretical point of view, the answer to this question in not obvious. According to the seminal models of tax competition (Zodrow and Mieszkowski, 1989, Wilson, 1991, Bucovetsky, 1991), capital mobility lead governments to strategically decrease their capital tax in order to prevent their country from capital outflows. This could explain the recent fall in corporate tax rates, and its greater intensity in more integrated areas such as the EU. Nevertheless, recent theoretical papers using a New Economic Geography (NEG) framework lead to different conclusions (Ludema and Wooton, 2000, Anderson and Forslid, 2003, Baldwin and Krugman, 2004, Ottaviano and Van Ypersele, 2005). They show the sensitivity of capital flows to the fiscal policies is tightly related with the level of trade integration. Hence, this is not capital mobility *per se* that influences tax interactions but rather the trade integration process. Interestingly, the fall in barriers to trade could have a positive or negative impact on corporate tax rates[2]. Moreover, while existing empirical studies focus on the impact

[1] The main global regions we consider are: 19 countries in the ASPAC region, the EU, the OECD, 19 countries in the ASPAC region, and 19 countries in the Latin American/Caribbean region.

[2] A well known result of the NEG literature on tax competition is the non-monotonous relationship between corporate taxes and the level of trade costs. Ludema and Wooton (2000), Anderson and Forslid (2003) show that there is a U-shaped relationship between corporate taxes and trade integration. By contrast, Baldwin and Krugman (2004) and Kind et al. (2000) show that when all the mobile tax base is located in a country, there is a hump-shaped relationship between the corporate tax of this country and the level of

of greater economic integration on taxation, they deserved few attention on the explanation of persistent fiscal disparities between countries. Which are the characteristics that allow some countries to sustain higher corporate tax rates without eroding their attractiveness? While the standard literature on tax competition fails to explain why bigger countries can set higher corporate tax rate without eroding their attractiveness, models of tax competition within a NEG framework explain this by the existence of an agglomeration rent in the biggest countries. Fiscal disparities might also be related to the differences in labor market imperfections between countries. Indeed, the literature on tax competition showed the negative effect of labor market rigidities on corporate tax rates, which could explain why some countries are constrained to set lower corporate rates than others.

To answer these questions, we will estimate reaction functions over corporate tax rates of OECD countries between 1983 and 1999. Our contribution is twofold. First, we use the disaggregated Trade and Production Database of the CEPII to build an index of trade integration based on the literature on border effects and we use it to estimate the sensitivity of tax interactions to the level of trade integration between countries. Secondly, we evaluate the impact of agglomeration economies and labor market rigidities on corporate tax rates.

There are two strands of the literature that contribute to the empirical evidence on tax competition. Indeed, to test whether the decline in corporate taxation is caused by the strategic behavior of governments or not, we need to find evidence on : (i) the sensitivity of firms' location choices to the fiscal policy, and (ii) fiscal interactions between governments. The first strand of the literature is aimed at estimating the tax base elasticity to the tax rate. By comparing the results of 25 empirical studies on the sensitivity of foreign direct investment to corporate taxation, De Mooij and Ederveen (2003) estimate the median value of the tax base elasticity to be -3.3. Since these results show that high corporate tax rates deter investments, we can expect governments to engage in a race to the bottom in corporate taxation. The second strand of the empirical literature estimates these strategic interactions among governments. More precisely, they estimate a reaction function over corporate tax rates whose slope gives the strength of tax interactions. There is a small but growing empirical literature that estimates these fiscal interactions between countries[3]. Devereux et al. (2007a) show

trade costs.

[3]The estimation of reaction functions was first applied to interactions between local governments (Brett and Pinkse (2000), Brueckner and Saavedra (2001), Buettner (2001), Hayashi et Boadway (2001), Revelli (2001a, 2001b), Charlot et Paty (2007)).

that between 1982 and 1999, governments of 21 OECD countries have competed over the statutory tax rate to attract profits and over the effective marginal tax rate to attract capital. Cassette and Paty (2007) and Redoano (2007) find evidence of tax interactions between EU countries. Both studies show that tax competition occurs in Europe mainly with respect to big leader countries. Hence, countries of the EU-15 seem to be more protected from tax competition than the PECO and can sustain higher corporate tax rates.

To our knowledge, existing empirical studies on tax interactions all build on the canonical models of tax competition according to which real capital flows are only driven by differences in fiscal policies. Thus, they focus on the impact of capital mobility on tax interactions in order to test the tax competition hypothesis. In reality, real capital flows are tightly related to firms' strategy to penetrate new markets. Numerous empirical studies show that FDI flows are directed toward countries with a good market access (for a survey, see Head and Mayer, 2004a). As a consequence, the sensitivity of capital flows to corporate tax rates could depend on the most important structural determinants of firms' location choice, such as the proximity to the biggest markets. Thus, the intensity of tax interaction between countries could be strongly related with the level of trade integration. To test this intuition, we evaluate the dependence of a country's fiscal policy to the fiscal policies of its most important trade partners.

Moreover, existing empirical studies deserve few attention on the explanation of fiscal disparities. Despite the dependence on the other countries' fiscal policy, some countries could be able to set higher level of corporate tax than others, because firms have non fiscal advantages to locate here that can compensate them for higher corporate taxes. According to the New Economic Geography literature, the proximity to the biggest markets is one of these important locational advantages that could contribute to explain why firms still locate in some high-tax countries such as countries of the G7 or the EU-15. This result is confirmed in some empirical studies on firms' sensitivity to the fiscal policy that take into account agglomeration economies (Brülhart et al. 2007, Devereux and Griffith 1998, Head and Mayer 2004b). However, existing studies on international tax interactions all do not consider the potential impact of agglomeration economies on fiscal policies[4]. We will try to fill this gap. Moreover, since NEG models of tax competition

[4]To our knowledge, Charlot and Paty (2007) are the only one whose empirical study on tax interactions take into account agglomeration economies. They find a positive relationship between the tax rate of urban jurisdictions in France and their market access, which suggests the existence of a taxable agglomeration rent.

show the influence on the fiscal policy of location forces coming from the demand side, there is no reason why location forces coming from the supply side would not influence tax interactions as well. Indeed, the labor cost and labor market rigidities can be important determinants of location choices made by firms[5]. Thus, we might expect that high labor market rigidities, by increasing the cost of labor and the level of unemployment, lead governments to decrease the level of corporate taxation to compensate firms for the higher labor costs and to decrease the level of unemployment. There are some theoretical papers showing that labor market imperfections affect tax competition (Ogawa et al. (2006), Boadway et al. (2004), Fuest and Huber (1999)). However to our knowledge, none of the empirical studies on tax interactions consider the potential effects of labor market characteristics on the fiscal policy. We will try to fill this gap by evaluating the impact of labor market rigidities on tax interactions.

To summarize, we distinguish our study from the existing literature by evaluating the impact of trade integration on tax interactions, and by evaluating the impact of location forces on corporate tax rates, whether they come from the demand or the supply side. Our main results are as follows. Firstly, we show the strongest tax interactions occur between countries that are important trade partners. Secondly, corporate tax rates increase with the market size and the market access of countries. As suggested by the NEG literature on tax competition, agglomeration economies seem to allow some governments to set higher corporate taxes, despite the dependence on other countries' fiscal policies. Thus, we show that trade integration matters for the tax policy through two channels: (i) on the one hand it reinforces tax interactions and accelerates the race to the bottom in corporate taxes, while (ii) on the other hand it makes it possible for countries to set higher corporate tax rates by improving their market access. We show that the second effect becomes insignificant when we control for the first one. This could explain the negative relationship between trade integration and corporate tax rates that we observed in OECD countries between 1983 and 1998. Finally, location forces coming from the labor market also influence the corporate tax policy since we show that the ability of countries to set high corporate tax rate decreases with the degree of government involvement in the wage-setting.

The paper will be organized as follows. In the following section, we es-

[5] Buettner and Ruf (2007) show that the probability that subsidiaries of German multinationals locate in a country decreases with the labor cost in this country. Bartik (1985) shows that high unionization has a very strong negative effect on new business activity in a state.

tablish some stylized facts about the evolution of corporate taxation and economic integration in OECD countries during the last two decades. Corporate tax rates in OECD countries have converged to the bottom over the period 1982-1999, and this evolution was strongly related with the level of economic integration. Thus, tax competition could have contributed to the recent decline in corporate taxation in OECD countries. In order to test this tax competition hypothesis and evaluate its intensity, we test reaction functions over different measures of corporate tax rates of 17 OECD countries between 1982 and 1999. The data and the econometric method are presented in section 3. Our strategy consists in estimating a reaction function over corporate taxes, using different measures of corporate taxation and different weighting matrices to see between which kinds of countries tax interactions are the strongest. Results are given in section 4, while the last section concludes.

2 Some stylized facts

We begin by a description of the evolution of corporate taxation in 20 OECD countries from 1982 to 2005. We observe a convergence to the bottom in corporate tax rates combined with a broadening of the tax base. Then, we use data on trade and foreign direct investment to see how far economic integration has gone during this period. Finally, we show that this recent trend of convergence to the bottom in corporate taxes is strongly related with economic integration, as suggested by the tax competition literature.

2.1 Corporate taxation

To describe the evolution of corporate taxation, we have to choose an indicator of the fiscal burden on firms. The measurement of corporate taxation is by itself a field of research that has experienced significant improvements recently[6]. We distinguish between two groups of corporate tax measures. The first one refers to *ex post* measures of corporate taxation defined as a ratio of tax revenues over the tax base[7]. They are backward looking measures that cannot capture the impact of taxes on the behavior of firms. By contrast, the second group is made of *ex ante* measures that take into account the fiscal legislation (statutory tax rate, depreciation allowances...) in order to evaluate the impact of taxes on the expected profits of a typical

[6] The different measures of corporate taxation are surveyed by Devereux et al (2002).
[7] These measures are also called implicit rates of taxation.

investment. Thus, they capture the influence of the fiscal policy on firms' investment incentives, which is at the heart of the tax competition literature. For this reason, we will restrict our attention to *ex ante* measures of corporate taxation.

We first present the evolution of statutory tax rates and effective tax rates available from the database of Devereux et al. (2007a). While the statutory tax rate is the most direct measure of the tax rate, the effective tax rates are theoretical measures combining information on both the tax rate and the tax base in order to estimate the effective fiscal burden on a typical investment. We distinguish between the effective average tax rate (EATR) which is aimed at evaluating the impact of taxes on location choices made by firms, and the effective marginal tax rate (EMTR) that matters for marginal investment choices made by firms conditional upon their previous location choice (Devereux and Griffith, 1998).

The evolution of these different measures of corporate tax rates is depicted in Figure 1 for 20 OECD countries between 1982 and 2005. The fall in these measures of corporate taxation was fairly continuous and more pronounced between 1985 and 1993 and between 1997 and 2002[8]. Moreover, this fall is more outstanding for the statutory tax rate (STATTAX) than for the effective tax rates that take into account the definition of the tax base, which suggests a broadening of the tax base. Finally, the fall in the EATR (-28,02%) was stronger than the fall in the EMTR (-21,61%).

- *Stylized fact 1: On average, corporate tax rates have fallen in OECD countries between 1982 and 2005 while the tax base was broadened*[9].

Looking at the evolution of the average level of corporate taxation in OECD countries is interesting to capture a common trend. However, it can be misleading to focus exclusively on this fact to evaluate the relevance of the tax competition hypothesis. As Benassy-Quéré et al. (2005) point out, the link between the tax level and the amount of investment located in a country is not obvious. This is particularly true for discrete investment choices. When a firm has to choose where to locate a new plant, what matters for her is the difference in taxation between countries rather than

[8] Spain is the only country in which the statutory corporate tax rate increased (by 2 points) during this period.

[9] This first stilyzed fact suggests the race to the bottom in corporate taxes does not systematically induce a fall in corporate tax revenues and public expenditures. As Devereux et al. (2002) show, share of GDP attributed to corporate tax revenues has remained fairly stable from 1965 to 2000.

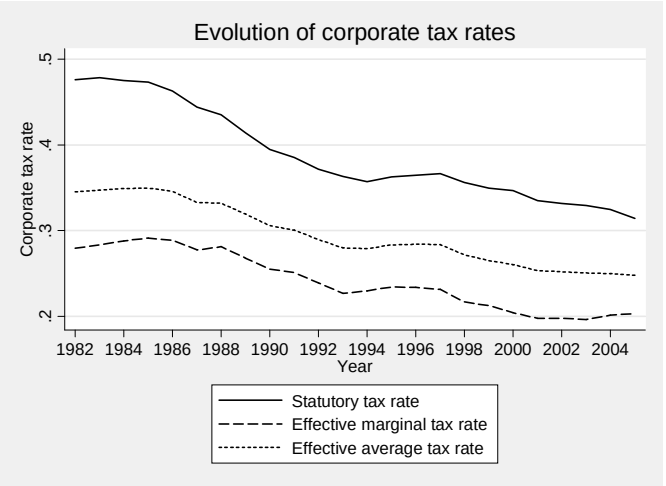

Figure 1: Evolution of corporate tax rates

the absolute level of taxation in each country. Thus, we describe in Figure 2 the evolution of the disparities in corporate tax rates between countries.

The decline in the standard deviation indicates a convergence of corporate tax rates between 1982 and 2005. More precisely, it seems that periods of strong decline in tax rates were combined with periods of strong convergence, except over the period 1990-1994 characterized by a slight increase in fiscal disparities and a decline in corporate tax rates. The strongest convergence occurred with respect to the EART whose standard deviation was divided by 2,94 between 1982 and 2005 while the standard deviation of the statutory tax rate and the EMTR were divided by around 2. Despite this convergence, observe that there are still important disparities in the level of corporate tax rates. In 2005, the highest EATR was observed in Japan and Netherlands (31,69%), while the lowest EATR was observed in Ireland where it was twenty points lower.

- *Stylized fact 2: The fall in the level of corporate taxation in OECD countries between 1982 and 2005 was combined with a convergence of corporate tax rates between these countries.*

To summarize, there are two dimensions in the evolution of corporate taxation in OECD countries that matter for tax competition and whose evolutions are strongly related: the decline in corporate taxation levels in each country, and their convergence between countries. Even if the convergence to the bottom in corporate tax rates looks like an evidence of tax

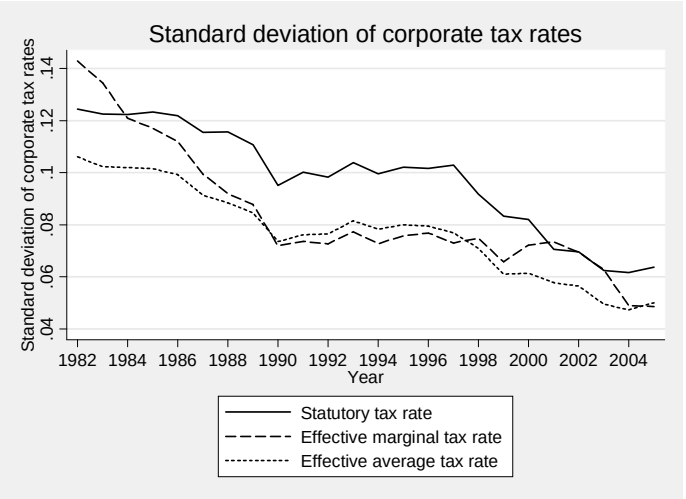

Figure 2: Evolution of the disparities of corporate taxation

competition, we cannot conclude anything from this observation. Recall that according to the tax competition hypothesis, the decline in corporate tax rates should be tightly related with the level of economic integration as far as it affects the tax base elasticity. Hence in the next subsection, we deal with the link between the evolution of corporate taxes and the evolution of economic integration.

2.2 Trade integration and factor mobility

Economic integration should matter for tax competition through two channels: the factor and the goods markets. Firstly, factor mobility is at the root of tax competition. As we are interested in international tax competition, we focus on economic integration on the capital market whose mobility is much higher than labor mobility. Secondly, it is also important to take into account the location forces driving capital flows. This is the main argument of the NEG literature analyzing tax competition in a framework with barriers to trade and increasing returns to scale (Ludema and Wooton (2000), Kind et al. (2000), Anderson and Forslid (2003), Baldwin and Krugman (2004), Ottaviano and Van Ypersele (2005)). Among these location forces, the level of trade integration plays an important role. On the one hand, the fall in barriers to trade could make capital more responsive to variations in corporate tax rates and strengthen tax competition (Ottaviano and Van

Ypersele (2005), Gaigné and Riou (2007)). On the other hand, as capital is unevenly distributed between countries, the decline in trade costs could foster the agglomeration of capital in some countries, creating rents for this factor that can be taxed without inducing a capital outflow. Hence, trade integration could make it possible for governments of these "core" countries to increase corporate taxes.

To approximate capital mobility and trade integration, we build indexes based on the observation of trade and capital flows[10]. Capital mobility is approximated by the flow of inward and outward Foreign Direct Investment (FDI) over the GDP. This measure is used in many empirical papers that estimate the impact of capital mobility on corporate tax rates because FDI data can be considered as a proxy for real capital flows (Garrett and Mitchell (2001), Dreher (2006), Garretsen and Peeters (2007), Dreher et al. (2007)). Regarding trade integration, we consider two different measures. The first one is trade openness (the sum of exportations and importations over the GDP) which is used in all empirical studies dealing with the effect of trade integration on fiscal policies. While this index is easy to build, it is quite inaccurate. By contrast, the literature on border effects (Mc Callum (1995), Wei (1996)) gives a method that allows to approximate more precisely the degree of trade integration by comparing international trade flows to trade flows at the subnational scale. We depart from this literature to build an index of trade integration. More precisely, we depart from the bilateral index of trade "phi-ness" described by Head and Mayer (2004a) to build an index of trade integration for each country of the sample. We believe this index is much more accurate then the trade openness index since it is deduced from a model of trade and location (the Dixit-Stigliz-Krugman model) while the trade openness variable is an *ad hoc* measure.

The different steps of construction of this index of trade integration are as follows. First, we use the "Trade and Production" database of Mayer and Zignago (2005), which compiles data of bilateral trade and production for 67 developing and developed countries at the ISIC rev2 3-digit industry level (26 industrial sectors) over the period 1976-1999, to calculate a bilateral index of trade "phi-ness" for each industry. Then, we deduce a bilateral index of trade "phi-ness" by weighting each sectorial index by the share of importations in each industry to take into account the degree of protectionism of countries. Thus, we get an asymmetric index of bilateral trade integration PHI_{ijt}

[10] We will call them *effective* measures of economic integration because they are based on the observation of trade and capital flows, as opposed to the measures that are based on the legislation and register restrictions of capital and trade flows through capital controls or tariff and non-tariff barriers to trade.

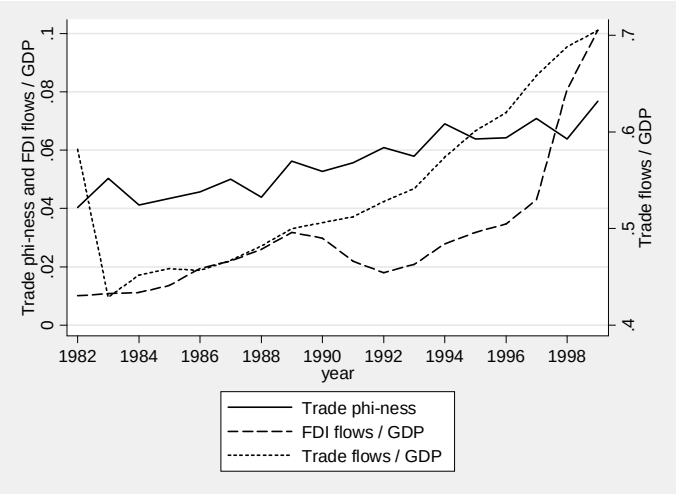

Figure 3: Evolution of economic integration

measuring accessibility of a given market i to imports from source j.[11]. Finally, we adopt the same method of aggregation (weighting by countries' share of importations) to get the final index of trade integration for each country PHI_{it}, which measures the accessibility of country i from all other countries of the database. These different steps of construction of the trade phiness index are summarized in the appendix A.2.

The Figure 3 shows the evolution of these measures of capital mobility and trade integration for 17 OECD countries[12]. In average, FDI flows over the GDP increased more than fivefold between 1983 and 1999. Trade integration also increased and this increase is more pronounced for the trade phi-ness index (+22.62%) than for the index of trade openness (+14.63%). Thus, it seems that the trade openness index underestimates the deepening of trade integration.

Therefore, the convergence to the bottom in corporate tax rates occurred during a period of increasing economic integration on capital and goods markets. More accurately, there is a negative correlation between corporate tax

[11] By contrast, the bilateral index of trade "phi-ness" coming from the D-S-K is symmetric because of the hypothesis of symmetric trade costs in this model. Our weigthing scheme based on the share of importations in each industry allows to get an asymmetric index of bilateral trade integration.

[12] We restrict our attention on the 17 OECD countries for which data was available for all these indexes and for all measures of corporate taxation.

rates and economic integration. To see whether the decline and convergence in corporate tax rates were related with the deepening of economic integration, we report in Table 1 the correlation coefficient between the yearly average of corporate tax rates and the yearly average of measures of economic integration, while we report in Table 2 the correlation between the yearly standard deviation of corporate tax rates and the yearly average of measures of economic integration.

Correl. coefficient	Trade phi-ness	Trade flows / GDP	FDI flows / GDP
$STATTAX$	**−0.900**	−0.757	−0.621
$EART$	**−0.915**	−0.797	−0.656
$EMRT$	**−0.918**	−0.854	−0.701

Table 1: Correlation between economic integration and corporate tax rates

Correl. coefficient	Trade phi-ness	Trade flows / GDP	FDI flows / GDP
$STATTAX$ (std dev)	**−0.849**	−0.740	−0.780
$EART$ (std dev)	**−0.861**	−0.695	−0.722
$EMRT$ (std dev)	**−0.797**	−0.567	−0.576

Table 2: Correlation between economic integration and corporate tax disparities

The highest correlation coefficients associate corporate tax rates (levels and standard deviation) to the trade phi-ness index. Interestingly, the choice of the measure of trade integration really matters since there is a significant difference between the correlation coefficients relating corporate tax rates to the trade-phiness index and those relating corporate tax rates to the trade openness index. With a simple linear regression depicted in Figure 4, we can see the very strong correlation between the EATR and the trade phiness index.

- *Stylized fact 4: The recent trend of convergence to the bottom in corporate tax rates was strongly related with the level of trade integration.*

Hence, because of the deepening of economic integration, governments of OECD countries might behaved strategically with respect to their fiscal policy by diminishing their corporate taxes in order to keep capital within their national borders. To test this tax competition hypothesis, we need to adopt an econometric approach that we describe in the next section.

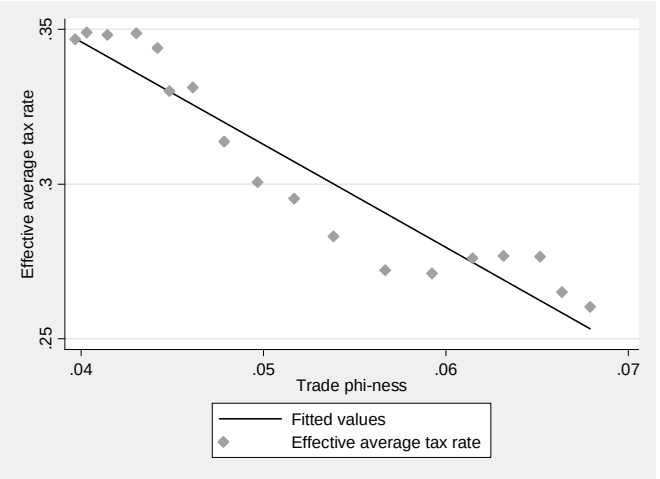

Figure 4: Trade phi-ness and the effective average tax rate

3 Econometric method and data

There are two different ways to test the tax competition hypothesis. While many empirical studies evaluate the direct impact of economic integration on corporate tax rates (Quinn, 1997, Swank, 2002, Bretschger and Hettisch, 2002, Dreher, 2006, Schwarz (2006), Rodrik (1997), Garrett and Mitchell (2001), Winner (2005)), we believe that relying on the estimation of reaction functions is a better strategy for two main reasons: (i) this approach is closer to the theory and (ii) it allows to evaluate the intensity of tax competition through the estimated slope of the reaction function.

Brueckner (2003) and Revelli (2005) give an excellent description of the empirical approach to estimate fiscal interactions[13]. According to the tax competition hypothesis, the amount of mobile tax base invested in a country i (b_i) depends on the corporate tax rate of that country (t_i), on the vector of tax rates in the other countries ($\mathbf{t}_{-i}$) and on a vector of economic characteristics of country i ($\mathbf{Y}_i$). One of the main drawback of the standard literature on tax competition, which assumes a neoclassical framework, is that it does not allow to define variables of the vector $\mathbf{Y}_i$. Indeed, capital flows in these models are exclusively driven by differences in fiscal policies.

[13] They deal with fiscal interactions coming from tax competition, yardstick competition (Besley and Case, (1995)), welfare competition (Wildasin (1991) et Brueckner (2000)) and expenditure spillovers (Case et al. (1993)).

By contrast, the literature of the NEG assuming imperfect competition, increasing returns to scale and trade costs, provides a framework that gives also "non fiscal" determinants of the capital flows. Thus, the amount of capital invested in country i is given by the following function:

$$b_i = H\left(t_i, \mathbf{t}_{-i}; \mathbf{Y}_i\right) \tag{1}$$

with $db_i/dt_i < 0$ and $db_i/dt_j > 0$. These properties mean that an unilateral increase in country i's tax rate or a decrease in other countries' tax rates generates a capital outflow from country i. Empirical studies estimating tax base elasticities support these properties (for a survey, see de Mooij and Ederveen (2003)).

Given this function of tax base allocation, the government of each country is supposed to maximize its residents' utility, which depends on their consumption of private goods (c_i), public goods (g_i), and on a vector of national characteristics ($\mathbf{X}_i$) such as the demographic structure of the population. Thus, the total welfare of residents of country i is given by the function:

$$u_i = u\left(c_i\left(b_i\right), g_i\left(b_i\right), \mathbf{X}_i\right) \tag{2}$$

To summarize, assuming that governments are benevolent and that they are aware of the way capital owners choose where to invest, we get their objective function by inserting the function (1) in residents' utility function (2). The maximization of this objective function with respect to t_i gives the first order condition and the resulting reaction function over corporate taxes that we want to estimate:

$$t_i = t\left(\mathbf{t}_{-i,t}, \mathbf{X}_i, \mathbf{Y}_i\right) \tag{3}$$

Assuming linearity of the reaction function, testing the tax competition hypothesis requires to estimate the following regression:

$$t_{i,t} = \sum_{j \neq i} \beta_{ijt} t_{jt} + \rho_1' \mathbf{Y}_{it} + \rho_2' \mathbf{X}_{it} + \rho_0 + \varepsilon_{it} \tag{4}$$

where β_{ijt} is the slope of the reaction function between country i and j at year t, and $\varepsilon_{i,t}$ is the error term. According to NEG models of tax competition, the slopes should be positive and increase with the strength of fiscal interactions[14].

[14] We do not deal with the specific case of asymetric competition between a country without mobile capital and a country with all capital.

3.1 Data set

We constructed a panel of data from 17 OECD countries over the period 1983-1999[15]. These countries are: Australia, Austria, Canada, Germany, Spain, Finland, France, Great-Britain, Greece, Italy, Ireland, Japan, the Netherlands, Norway, Sweden, Portugal and the United States of America. Data definitions, summary statistics, and sources are given in Table 6 of Appendix A.5.

Dependent variable Let us first describe the choice of the dependent variable of corporate taxation t_{it}. Since both the tax rate and the tax base are relevant in determining incentives for investment, governments should act strategically with respect to their *effective tax rates* in order to affect the location of the tax base the more efficiently as possible. However in practice, changing the definition of the tax base can be very costly for governments and the comparison of tax base across countries can be very complicated for firms[16]. For these reasons, tax competition could essentially occur over the statutory tax rates, easily handled by governments and whose comparison across countries by firms is more direct.

In order to know with respect to which measure of corporate taxation fiscal interactions are the strongest, we estimate reaction functions over both effective tax rates and the statutory tax rate. The comparison of the results with the two measures of effective tax rates (marginal and average) can also be interesting. Indeed, recall that the effective marginal tax rate is relevant for marginal investments that do not generate profits, contrary to discrete investments that depend on the effective average tax rate. Thus, we could expect tax competition for the discrete investments (over the EART) to be fiercer than tax competition for marginal investments (over the EMRT).

Vector $\mathbf{Y}_{it}$ Recall that variables of the vector $\mathbf{Y}_{it}$ refer to "non fiscal" variables that matter for the location of the tax base across countries. We rely on the NEG literature to choose these variables.

Let us consider models of tax competition within a NEG framework with mobile capital and immobile labor (Baldwin et al., 2003, Ottaviano and

[15] We depart from the tax database of Devereux et al. (2007a) which gives different measures of corporate taxation for 20 OECD countries. We lose 3 countries from this database because of data availibility problems with respect to the other variables of the regression. The final sample is balanced.

[16] The definition of effective tax rates, taking into account the definition of the tax base, involves complex rules and hypotheses that make their comparison across countries quite difficult.

Van Ypersele 2005, Haufler and Wooton 2007, Gaigné and Riou, 2007)[17]. Assuming equal corporate taxes in all countries, these models predict that capital will be drawn to areas with good access to major markets for final goods, because firms want to save on trade costs and exploit increasing returns to scale. Thus, trade integration plays a major role in the spatial distribution of the tax base. The lower trade costs are, the more firms located in a country raise profits by deserving foreign demand through exportation. Said differently, the attractiveness of a country i increases with its market potential, which was first defined by Harris (1964) as the sum of demand emanating from all countries divided by their bilateral distance with respect to country i. These location forces matter for the tax competition outcome. Indeed, the agglomeration of firms in the biggest markets creates rents for this factor that can be taxed by the government without inducing a capital outflow, allowing the biggest countries to set higher corporate tax rates. This could contribute to explain why G7 countries set higher corporate taxes without eroding their attractiveness.

We test this theoretical prediction by adding two variables in the vector $\mathbf{Y}_{it}$ that allow to distinguish between the local and the non local component of the market potential. The first variable is the national apparent consumption of country i (ABS_{it}, defined as production - exports + imports) which is a proxy for its national market size. The second variable is the market access (MA_{it}) that captures the non local component of the market potential. It is defined as the sum of demand coming from high income countries $j \neq i$ multiplied by the bilateral trade phi-ness index between country i and j[18]. We expect these variables to have a positive effect on corporate taxation.

Vector $\mathbf{X}_{it}$ Variables of the vector $\mathbf{X}_{it}$ does not necessarily matter for the tax base location but could affect residents' welfare and thus governments fiscal policy through other channels.

- The size of the public sector is approximated by a variable public consumption over the GDP, lagged one year to avoid an endogeneity

[17] We restrict our attention to the NEG models characterized by labor immobility and (physical) capital mobility because these models are more adapted to deal with international tax competition than models with labor mobility.

[18] An alternative to build the market access variable is to follow Harris by calculating the sum of demand from other countries divided by their distance with respect to country i. This is done by Charlot and Paty (2007). The main drawback of this approach is that the inverse of distance is an inaccurate proxy for trade integration. Thus, we prefer to build our market access variable by approximating trade integration by the bilateral trade integration index described in appendix A.2.

bias ($PCONS_{i,t-1}$). We expect this variable to have a positive impact on the corporate tax rate as it calls for more fiscal revenues to finance public goods.

- We introduce the highest domestic income tax ($TINC_{it}$) because of the possibility of interdependence between this tax rate and the corporate tax rate. On the one hand, we could observe a positive relationship between these two tax rates because the corporate tax rate could act as a backstop for the income tax. Indeed, individuals could be incited to escape tax on their earnings by incorporating themselves[19]. On the other hand, the corporate tax and the income tax could be substitutes according to the tax competition hypothesis since governments could report the fiscal burden on the less mobile tax bases.

- We also introduce socio-demographic variables to control for the effect of the structure of population on the fiscal policy. Among the demographic variables, we introduce the share of young people (YOU_{it}), the share of old people (OLD_{it}) and the share of people living in urban areas (URB_{it}). Moreover, we follow Cassette and Paty (2007) by introducing a variable of standardized unemployment rate, lagged one year to avoid an endogeneity bias ($UNEMP_{i,t-1}$). Indeed, a high level of unemployment could give governments an additional incentive to decrease corporate taxation to favor job creation by domestic firms or to prevent their delocalization[20].

- Finally, we control for the impact of the business cycle on the fiscal policy with a variable of GDP growth from year $t-1$ to year t ($GDPGR_{it}$). On the one hand, economic growth could result in lower corporate taxation. Indeed, a positive productivity shock increases the home interest rate, which induces a capital inflow. Thus, governments could lower their tax rates during economic upturns to have a balanced budget (Bretschger and Hettich, 2002). On the other hand, a strong economic growth increases firms profitability and the corporate tax base so that governments could sustain higher corporate tax rates while they would reduce corporate tax rates in periods of slow economic growth to stimulate the economy (Basinger and Hallerberg, 2004).

[19] Gordon and Slemrod (2000) and Gordon and MacKie-Mason (1995) estimate this effect and its policy implication.

[20] The eligibility for tax deductions or subsidies given by governments is sometimes contingent on a minimum employment level.

3.2 Econometric issues

We have to deal with four main problems to estimate the reaction function over corporate taxes (4).

Degree of freedom Firstly, it is impossible to estimate the regression (4) as it stands. In theory, each government could respond differently to the tax rates of every other countries. However there are too much parameters to estimate with such a regression. Hence, we follow the empirical literature by replacing the vector of other countries' tax rates $\mathbf{t}_{-i,t}$ by the average tax rate of those countries $\bar{t}_{-i,t}$ defined as:

$$\bar{t}_{-i,t} = \sum_{j \neq i} \omega_{ijt} \times t_{jt} \tag{5}$$

where ω_{ijt} are exogenous weights of a matrix and are normalized such that $\sum_{j \neq i} \omega_{ijt} = 1$[21]. Thus, the estimated equation written in matrix form is:

$$t = \beta W t + \rho_y Y + \rho_x X + \varepsilon \tag{6}$$

with W the weighting matrix made of weights ω_{ijt} for each pair of countries i, j. The sensitivity of country i's corporate tax rate to country j's tax rate will be given by the expression $\partial t_{it} / \partial t_{jt} = \hat{\beta} \omega_{ijt}$, while the estimated coefficient $\hat{\beta}$ gives the sensitivity of country i's fiscal policy to all countries of the sample. As Brueckner and Saavedra (2001) and Brueckner (2003) indicate, the weights are imposed *ex ante* and chosen in order to identify between which types of countries fiscal interactions are the strongest. We consider five possible weighting schemes to calculate (5). In the Table 5 of the appendix A.4, we report the five pairs of countries for which the weight attributed to country j by country i in the choice of its fiscal policy are the highest in 1999, for each weighting matrix.

According to the tax competition literature, economic integration is at the heart of fiscal interdependencies between countries. As a consequence, we expect tax interactions to be stronger between well integrated countries. Tax interactions come only from capital mobility according to the standard literature of tax competition. By contrast, NEG models of tax competition endogenize capital mobility by taking into account international trade flows and show that what really matters is the process of trade integration that

[21] This normalization is necessary to get comparable coefficients of fiscal interactions across the different matrices.

makes capital more responsive to fiscal policies. Thus, we build matrices based on integration on the capital and the goods market.

We first follow the empirical literature on tax interactions by using a matrix based on FDI flows (W^{FDI}) to capture integration on the capital market. More precisely, we follow Cassette and Paty (2007) by choosing an index of intensity of FDI in countries with which country i is in interaction. The elements of this matrix are given by:

$$\omega_{ij,t}^{FDI} = FDI_{j,t-1} / \sum_{j \neq i} FDI_{j,t-1}$$

with $FDI_{j,t-1}$ the sum of inward and outward FDI flows over GDP in country j. Weights are lagged one year in order to avoid endogeneity problems[22]. A high and significant coefficient associated to this weighting matrix ($\hat{\beta}^{FDI}$) would mean that a government is more sensitive to the tax policy of other countries when those countries generate or hosts important flows of FDI. According to this weighting scheme, in 1999, many OECD countries should choose their tax rate depending on the fiscal policy of Sweden (see Table 5).

While the matrix W^{FDI} is aimed at capturing only the mobility of real capital, it also captures international trade flows that are associated with these FDI flows. Thus, we would like to evaluate the effect of trade integration on interactional tax interactions. Most of the empirical studies on tax interactions do not investigate this. They just consider the trade openness variable as a control variable in the tax reaction function (Devereux et al (2007a), Redoano (2007), Cassette and Paty (2007)). The only exception is Redoano (2007). However, its weighting matrix is based on the trade openness variable which is quite inaccurate. In order to disentangle the effect of trade integration on tax interactions, we build a weighting matrix (W^{PHI}) based on the bilateral index of trade phiness PHI_{ijt} averaged over the five previous years. More precisely, the elements of this weighting matrix are:

$$\omega_{ijt}^{PHI} = PHI_{ijt} / \sum_{j \neq i} PHI_{ijt}$$

A high and significant coefficient associated to this weighting matrix ($\hat{\beta}^{PHI}$) could result from the positive impact of trade integration on the tax base elasticity that could lead governments to act more strategically with respect to their corporate tax policy. Observe from Table 5 that the pair of countries

[22] There is a large body of empirical literature that show the impact of corporate tax rates on FDI flows (Benassy-Quéré et al. (2005), de Mooij et Ederveen (2003)).

for which we get the highest weights are Canada-USA (the weight attributed to the Canadian fiscal policy by the US government reaches 0.68 while the weight given to the US fiscal policy by the Canadian government is 0.48). Then, we get the weight given by the Irish government to the Bristish fiscal policy (0.34), the weight given by the Finnish government to the Swedish fiscal policy (0.31), and the weight given by the Austrian government to the German fiscal policy (0.30).

We also build a weighting matrix (W^{DIST}) that takes into account the geographic distance between countries and which is constructed as follows:

$$\omega_{ij}^{DIST} = \frac{1}{dist_{ij}} / \sum_{j \neq i} \frac{1}{dist_{ij}}$$

with $dist_{ij}$ the geodesic distance between country i and j[23]. This is also a proxy for the degree of economic integration since trade costs and the costs of capital mobility increase with the distance.

Moreover, we can expect fiscal interactions to be stronger between countries with similar economic characteristics. Thus, we follow Redoano (2007) and Cassette and Paty (2007) by building a weighting matrix W^{GDPC} based on the inverse of the distance between GDP per capita, such that:

$$\omega_{ijt}^{GDPC} = \frac{1}{|GDPC_{it} - GDPC_{jt}|} / \sum_{j \neq i} \frac{1}{|GDPC_{it} - GDPC_{jt}|}$$

with $GDPC_{it}$ the GDP per capita.

As suggested by Redoano (2007), we also introduce a matrix based on economic leadership W^{GDPL}, to test the possibility that countries choose their fiscal policy by following a leader country. The weights of this matrix are defined as follows:

$$\omega_{ij,t}^{PIBTL} = PIBT_{j,t-1} / \sum_{j \neq i} PIBT_{j,t-1}$$

Finally, we use a uniform matrix (W^{UNI}) such that the corporate tax rate of each country is equally weighted:

$$\omega_{ij}^{UNI} = 1/(n-1)$$

This uniform matrix plays the role of benchmark since it gives the strength of fiscal interdependencies between countries whatever their characteristics. If

[23] We used the CEPII database on bilateral distances.

the coefficient $\hat{\beta}^{UNI}$ is significant and higher than the coefficients induced by the other matrices, it will support Manski's (1993) hypothesis of "common intellectual trend" that drives countries fiscal choices in the same directions independently of their level of economic integration.

Endogeneity Strategic interactions over corporate tax rates imply that they are simultaneously determined. Hence, the average corporate tax rate of other countries $\bar{t}_{-i,t}$ is correlated with the residuals (Anselin (1988)). We use the instrumental variables method to deal with this endogeneity bias[24]. More precisely, as suggested by Kelejian and Robinson (1993) and Kelejian and Prucha (1998), we regress in a first step Wt on WX and use the predicted values $\hat{W}t$ as instruments for Wt[25]. Moreover, the variable of top income tax rate should also be treated as endogenous since the governments could decide simultaneously its corporate tax rate and its income tax rate. We follow Devereux et al. (2007b) by instrumenting the variable $TINC_{it}$ by its lagged value. We test the validity of these instruments by the Hansen test of over-identifying restrictions.

Finally, the market size and market access variables could also be endogenous, since demand comes in part from mobile entrepreneurs whose location choices should depend on the corporate tax policy. We lagged those variables for one year to avoid an endogeneity bias.

Heterogeneity We need to account for spatial and temporal heterogeneity since it could involve non observable characteristics that matter for the fiscal policy. Hence, we introduce fixed country effects α_i. However, as Devereux et al. (2007a) explain, we cannot introduce year dummies to capture shocks in each period which are common to all countries. Indeed, observe that when we use the uniform matrix, the effect of the year dummy is already present in variable $\bar{t}_{-i,t}$, that we can rewrite $\bar{t}_{-i,t} = (\bar{t}_t - t_{i,t}) / (n-1)$ with $\bar{t}_t$ the sum of tax rates of all the countries of the sample. Hence, instead of a year dummy, we take into account unobservable factors varying over time through a linear time trend common to all countries T_t[26].

[24] We use the *xtivreg2* command of Stata to implement the IV method.

[25] As Brueckner (2003) suggests, other possibility to deal with this endogeneity bias would be to estimate the reaction function by maximum likelyhood (ML) methods. However, we prefer to use the IV method this method generates a consistent estimate of $\hat{\beta}$ even in the presence of spatial error dependence (Kelejian and Prucha (1998)).

[26] We also estimated the regressions with a country specific linear time trend. The results are very similar to those we get with a common time trend.

Serial correlation We observe a strong inertia in the evolution of corporate tax rates over time. There are several reasons for this inertia: abrupt changes in tax rates might involve too important adjustments costs for the private sector, and they are politically difficult to defend because of the pressure coming from interest groups who lose from these changes (see Devereux et al. (2007a)). A direct consequence of this inertia is serial correlation. In order to deal with this bias, we follow Devereux et al. (2007b) by including a lagged dependent variable. As it is well known, this lagged dependent variable is correlated with the fixed effects, and thus treating it as exogenous may lead to biased estimates. We address this problem by treating this variable as endogenous and instrumenting it by the second lag of the dependent variable. We also present the results of Wooldridge's test of serial correlation[27].

To summarize, we will estimate the following regression with spatial and temporal autoregression:

$$t_{it} = \theta t_{i,t-1} + \beta \bar{t}_{-i,t} + \rho_y' \mathbf{Y}_{it} + \rho_x' \mathbf{X}_{it} + T_t + \alpha_i + \varepsilon_{it} \tag{7}$$

4 Results

We begin by a description of the results with the EATR as dependent variable. We first estimate the impact of agglomeration economies and trade integration influence tax interactions. Then, we undertake some robustness checks. Finally, we investigate the role played by the labor market in tax competition by adding in the vector $\mathbf{Y}_{it}$ variables which refer to labor market characteristics.

4.1 Do trade integration and agglomeration economies influence fiscal interactions?

We first estimate the autoregressive spatial regression (7) with the constraints that $\theta = 0$. The results show a strong serial correlation and are not reported. We address this problem by estimating the autoregressive spatial ($\beta \neq 0$) and temporal ($\theta \neq 0$) model. Results of this estimation are reported in Table 3, where each column refers to the weighting scheme used to calculate the variable of average EATR in other countries.

The lagged dependent variable is strongly significant, as we expected. Its coefficient varies between 0.675 and 0.712, which shows a high persistence

[27] An alternative solution to deal with serial correlation is to estimate of the reaction function in dynamic panel. This is done by Cassette and Paty (2007) and Redoano (2007).

Weigthing matrix	$\mathbf{W}^{UNI}$	$\mathbf{W}^{PIBTL}$	$\mathbf{W}^{PHI}$	$\mathbf{W}^{IDE}$	$\mathbf{W}^{DIST}$
Lagged EART	0.712^a	0.705^a	0.675^a	0.704^a	0.680^a
$(t_{i,t-1})$	(0.077)	(0.077)	(0.086)	(0.077)	(0.085)
EATR of countries $j \neq i$	0.463^c	0.492^c	0.609^b	0.318^c	0.486^c
$(\bar{t}_{-i,t})$	(0.237)	(0.256)	(0.293)	(0.167)	(0.253)
Top income tax rate	0.040	0.045	0.020	0.040	0.021
$(TINC_{it})$	(0.038)	(0.035)	(0.041)	(0.038)	(0.042)
Share of old people	-0.180	-0.132	-0.263	-0.140	-0.301
(OLD_{it})	(0.295)	(0.302)	(0.302)	(0.299)	(0.289)
Share of young people	-0.235	-0.206	-0.074	-0.201	-0.298^c
(YOU_{it})	(0.154)	(0.154)	(0.165)	(0.154)	(0.165)
Share of urban people	-0.110	-0.095	0.090	-0.089	-0.141
(URB_{it})	(0.172)	(0.173)	(0.188)	(0.170)	(0.183)
Pub. cons. expenditures	-0.061	-0.060	-0.023	-0.055	-0.049
$(PCONS_{i,t-1})$	(0.042)	(0.042)	(0.044)	(0.042)	(0.043)
Market size	0.006^b	0.006^b	0.003	0.006^b	0.004^c
(ABS_{it})	(0.003)	(0.003)	(0.002)	(0.002)	(0.002)
Market access	0.007^c	0.007^c	0.002	0.007^c	0.002
(MA_{it})	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Unemployment rate	-0.149	-0.154	0.004	-0.149	-0.061
$(UNEMP_{i,t-1})$	(0.109)	(0.113)	(0.110)	(0.108)	(0.105)
GDP growth	0.023	0.015	0.012	0.021	0.025
$(GDPGR_{it})$	(0.032)	(0.031)	(0.032)	(0.031)	(0.033)
Trend	0.001	0.001	0.002	0.000	0.001
(T_t)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Country fixed effects	yes	yes	yes	yes	yes
Number of observations	272	272	272	272	272
Adjusted R^2	0.801	0.799	0.795	0.802	0.798
Hansen statistic (prob)	0.345	0.882	0.591	0.283	0.561
Serial correlation test (prob)	0.171	0.130	0.274	0.178	0.194
Endogeneity test of $\bar{t}_{-i,t}$ (prob)	0.002	0.006	0.065	0.008	0.057
Endogeneity test of $TINC_{i,t}$ (prob)	0.002	0.005	0.013	0.002	0.016

Notes: Robust standard errors in parentheses. [a] *significant at 10%,* [b] *significant at 5%,* [c] *significant at 1%.*

Table 3: Estimation of tax interactions over the EATR

of EATR over time. The equation now passes the serial correlation test of Wooldridge's (2002), except with the weighting matrix based on the difference in GDP per capita (W^{GDPC}) whose results are not reported. Moreover, results of the Durbin-Wu-Hausman test of endogeneity indicate that variables $\bar{t}_{it}$ and $TINC_{it}$ are endogenous and need to be instrumented. Finally, the equation passes the test of overidentifying restrictions with all matrices at conventional significance levels.

The coefficient of fiscal interactions, $\hat{\beta}$, is significant at 10% and positive for all weighting matrices. It reaches its lowest value (0.318) with the matrix based on FDI intensity (W^{FDI}) and its highest value (0.609) with the matrix based on the level of bilateral trade integration (W^{PHI}). The estimated coefficients are quite similar to those estimated by Devereux et al. (2007a) on the EMRT of 21 OECD countries over the same period and to those estimated by Cassette and Paty (2007) on the statutory tax rate of 27 European countries between 1995 and 2005. The fact that the coefficient $\hat{\beta}$ reaches its highest value and level of significance with the matrix based on the bilateral levels of trade integration W^{PHI} indicates that fiscal interactions are the strongest between important trade partners. Thus, tax competition would be the most intense between Canada and the USA and between Ireland and Great-Britain. This result contrasts with those of Redoano (2007) who find a significant impact of trade openness on tax interactions over statutory tax rate in UE countries, but with a coefficient twice lower than the one we get using a measure of trade phi-ness[28]. This high level of $\hat{\beta}^{PHI}$ could result from the positive impact of trade integration on the tax base elasticity, as suggested by NEG models of tax competition[29]. Said differently, a high level of trade integration between countries would make location choices more and more sensitive to tax differentials between countries, so that governments would be more and more dependent on the fiscal policy of their most important trade partners. Moreover, observe that the lowest coefficient of tax interaction is the induced by the matrix W^{FDI}. The fact that $\hat{\beta}^{PHI}$ is higher and more significant than $\hat{\beta}^{FDI}$ suggests that maybe this is not capital mobility *per se* that matters for tax competition but rather the trade integration process. However, the matrix based on the index of capital mobility yields the highest R^2. Thus, both channels of economic integration seem to matter for tax competition.

[28] Moreover, results of Redoano might be biased upward as she does not control for the positive impact of the income tax on the statutory tax rate.

[29] To our knowledge, the impact of trade integration on tax base elasticity has not been investigated empirically yet and it would be very interesting to test whether the fall in trade costs reinforces tax base elasticity or not.

Among the control variables ($\mathbf{X}_{it}$), the share of young people is the only one that affects significantly the EART, when the matrix based on the inverse of distance is used. As Devereux et al. (2007a), we find a negative sign associated to this variable. Public expenditures do not affect significantly the EATR as in Slemrod (2004). More surprisingly, the income tax rate is also insignificant. This result contrasts with those of Cassette and Paty (2007), Devereux et al. (2007a) and Slemrod (2004) who find that the income tax rate has a significantly positive impact on the level of corporate taxation. Finally, the variable of unemployment rate is not significant. While we were expecting the unemployment rate to induce governments to decrease corporate taxation to favor job creation, this does not appear to be the case because of the ambiguous impact of unemployment on firms location choice. As Disdier and Mayer (2004) explain, a high level of unemployment might signal the availability of a large pool of workers which could have a positive effect on location choice made by firms, but it might also deter investments if this unemployment results from strong rigidities on the labor market.

Now I come to variables of the vector $\mathbf{Y}_{it}$ that should matter for firms location choices and thus for the tax base elasticity. As predicted by the NEG models of tax competition, the market size and the market access both have a positive impact on the EART. These results are consistent with those of Garretsen and Peeters (2007) who show that the corporate tax rate of OECD countries is positively related with their market potential. Moreover, the fact that the market access variable is positive and significant indicates that contrary to Devereux et al. (2007a) and Redoano (2007), trade integration might have also a direct effect on government fiscal policy[30]. While these results are consistent with predictions made the NEG models of tax competition, they should be interpreted with caution. Indeed, we can see in the third column that these variables are no more significant when the matrix based on bilateral trade integration is used. There is an explanation for this result. By definition, the market access variable takes into account interdependencies between countries since it is based on bilateral trade phiness. This bilateral trade phiness is also taken into account in the variable of average EART of other countries when the weighting scheme is based on trade integration W^{PHI}. Thus, the regression using the matrix W^{PHI} is the only one that include the two channels through which trade integration might affect fiscal choices: (i) the impact of trade integration on tax interac-

[30] Devereux et al. (2007a) and Redoano (2007) find no significant impact of trade openness on corporate tax rates.

tions through the tax base elasticity is captured by the variable $\bar{t}_{-i,t}$, while (ii) the impact of trade integration on fiscal choices through agglomeration economies is captured by the market access variable. The fact that only the effect (i) is significant suggests that the net effect of trade integration on corporate taxation is negative, so that OECD countries would be concerned by the downward sloping part of the non-monotonous relationship between trade integration and corporate tax rates predicted by some NEG models of tax competition.

4.2 Robustness checks

If the previous results give evidence on tax interactions over the EATR, it is more difficult to identify the source of these interactions. Indeed, there are different models that predict such fiscal interactions (Brueckner, 2003, Revelli, 2005).

Firstly, what looks like fiscal interactions might result from a common intellectual trend, as suggested by Manski (1993). Since fiscal interactions are always significant with the uniform matrix, we cannot reject this hypothesis. Nevertheless, we cannot reject the tax competition hypothesis as well for two reasons. As Brueckner (2003) concludes in his paper, the evidence of tax competition should be appreciated from estimates of the structural equations that generate the reaction function. Since there is a growing literature showing that high corporate taxes deter investments (De Mooij and Ederveen (2003)), we cannot reject the tax competition hypothesis. Moreover, the comparison of the estimated slopes on the reaction function gives evidence of tax competition. Indeed, observe that all weighting matrices except W^{FDI} yields higher coefficient of tax interactions than the uniform matrix. Thus, the strength of tax interactions is higher between neighboring countries, between important trade partners or with respect to leader countries. To summarize, there is empirical evidence that support the tax competition hypothesis with respect to both the auxiliary equation (the tax base elasticity) and the reduced form equation (the tax reaction function).

Secondly, tax interactions could result from yardstick competition (Besley and Case (1995), Besley and Smart (2003), Bordignon et al. (2003, 2004)). It occurs when policy makers in one country adjust their policy in response to neighboring countries because citizens compare domestic and foreign policies to make their voting decisions. However, as Redoano (2007) explains, yardstick competition is more likely to occur with respect to those policies that voters care the most. As far as corporate taxes hit income from capital and are of interest for a minority of voters, we can consider that the risk of

yardstick competition over corporate tax rates is limited. Moreover, in case of yardstick competition over corporate tax rates, the strength of fiscal interactions would not increase with the level of trade integration. Hence, tax interactions over corporate tax rates does not seem to result from yardstick competition.

To summarize, tax competition could be just one reason among others that explains why countries should be affected by their "neighbors" when they set their fiscal policy. What matters is the relative importance of the tax competition hypothesis with respect to the other ones. In order to discriminate between these different explanations, most of the empirical studies just compare the predicted value of $\hat{\beta}$ depending on the weighting matrices used. The fact that the matrices W^{PHI}, W^{DIST}, and W^{PIBTL} yield the highest level of tax interactions suggests that the tax competition hypothesis is quite strong since tax interactions are the strongest between well integrated countries while according to the common intellectual trend hypothesis or the yardstick competition hypothesis, the strength of tax interactions should not be related to the level of economic integration. Interestingly, the lowest coefficient of tax interaction is induced by the matrix based on capital mobility W^{FDI} why we expected from the tax competition hypothesis that this weighting scheme would induce a high coefficient. This might result from the two important weaknesses of the index of capital mobility based on FDI data. Firstly, FDI data are a very imperfect proxy for real capital flows since 60% of FDI flows result from mergers and acquisitions in developed countries (OECD, 2000). These financial flows react differently to corporate taxation (Auerbach and Hassett (1993). Swensson (2001) showed, by distinguishing between six forms of FDI, that corporate tax deter real investments in US States while they have a positive impact on the amount of FDI associated to mergers and acquisitions. Since the FDI variable encompasses those two kinds of capital flows, we might underestimate the strength of tax interactions between countries characterized by important real capital flows. Secondly, this measure of FDI flows over the GDP suffer from the same limits as the trade openness variable as far as it is an *ad hoc* index. It would be interesting to improve this index of economic integration on the capital market to see if it changes the results[31].

[31] Devereux et al. (2007a) address this problem by running regressions which allow for the reaction function coefficients to vary with the strength of legal controls on capital movements in both the country setting the tax and the average of such controls across all the other countries with which that country is competing. However, their weigthing matrix taking into account economic integration of the capital market is still based on FDI flows over the GDP.

To evaluate the relevance of the tax competition hypothesis with respect to the other ones, it seems also interesting to compare the results of the regressions with respect to the dependent variable. In the Table of the appendix A.5., we give the results of the estimation across the different measures of corporate taxation with the matrix W^{PHI}[32]. Firstly, we expect tax competition to be stronger over profitable investments. Thus, we expect tax interactions to be stronger over the EATR than other the EMTR. The results confirm this intuition. Indeed, observe first that the adjusted R^2 induced by the estimation of tax reaction over the EART (0.795) is higher than the adjusted R^2 of the tax reaction over the EMTR (0.752). Moreover, the coefficient of tax interactions over the EMRT is non significant while it is significant at 5% with respect to the EATR. Thus, if there is fiscal competition, it seems to be to attract profitable investments, which show the limits of the standard literature on capital tax competition in a neoclassic framework. Secondly, we expect tax interactions over the statutory tax rate ($STATTAX_{it}$) to important and significant for three reasons: (i) it could be easier for governments to manipulate statutory tax rate than to change the definition of the tax base, (ii) the comparison of statutory tax rate between countries is easier for firms than the comparison of EATR, and (iii) governments could compete over statutory tax rate to attract profits made by multinationals having a tax optimization behavior (Devereux et al, 2007a). Our results are consistent with this intuition, the highest predictive power (with a R^2 equal to 0.803) comes from the estimation of the tax reaction function over statutory tax rates, which also yields the highest coefficient of tax interactions ($\hat{\beta}^{PHI} = 0.684$).

To conclude, even if we cannot completely disentangle the extent to which estimated tax interactions come from tax competition, there is evidence that tax competition contributes to the explanation of these interdependencies since: (i) tax interactions are stronger between trade partners, (ii) there are tax interactions over the EATR but not over the EMTR, (iii) the strongest tax interactions occur over statutory tax rates.

4.3 Do labor market rigidities influence tax interactions?

The above results indicate that both trade integration and the location of demand matter for fiscal choices of governments. What about location forces coming from the supply side? The existing models of tax competition

[32] We do not give the results with the other weigthing matrices as they do not pass the serial correlation test of the test of over-identification of restrictions.

for (physical) capital within NEG frameworks do not answer this question. Indeed, as they assume physical capital to be internationally mobile and human capital to be immobile, the wage of immobile workers is normalized to unity through the traditional sector. Thus, firms' location choice does not depend on the labor cost, while in reality location choices can be partly driven by the search for lower labor costs. Several empirical studies show that high labor costs deter investments (Buettner and Ruf (2007), Bartik (1985), Crozet et al., 2004, Mayer et Muchielli, 1999, Cheng et Kwan, 2000, Buettner et Ruf, 2007), even if others show that its effect is positive or non significant (Devereux and Griffith, 1998; Head et al., 1999, Benassy et al., 2005)[33].

As far as labor costs can affect firms' location choice, they could also influence fiscal choices made by governments. However, few models of tax competition deal with the impact of the labor market characteristics on tax competition. In an extension of the model of Zodrow and Mieszkowski (1989), Sato et al. (2006) show that tax competition is fiercer when a minimum wage rate is applied provided that labor and capital are complements. Likewise, Exbrayat et al. (2007) show, in a model of trade and firm location, that labor market imperfections (through a minimum wage or through wage bargaining by a monopoly union) reinforce the tax base elasticity, and thus foster tax competition.

To our knowledge, none of the empirical studies on tax competition consider the potential role for labor market imperfections and the labor cost on fiscal choices made by governments. To fill this gap, we introduce two additional variables in the vector $\mathbf{Y}_{it}$ of countries' characteristics that might influence firms location choice, and thus the fiscal policy. The first variable is the unit labor cost in the manufacturing sector (ULC_{it}). The second one is the index of Golden et al. (2006) measuring the involvement of government in the wage setting (REG_{it})[34]. As both variables are expected to increase the labor costs, we expect them to deter investments and lead governments to decrease their corporate tax rates.

The table 4 gives the results of this new regression. The data set for this estimation is restricted to 14 countries because we had no data of labor market characteristics for Greece, Ireland and Portugal. We report only re-

[33] It is difficult to evaluate the effect of the labor cost on location choices made by firms as the labor cost is positively correlated with labor productivity that we expect to have a positive effect on firms location choice.

[34] For details, see the appendix.

Dependent variable	**STATTAX**	
Lagged EART	0.615^a	0.605^a
$(t_{i,t-1})$	(0.118)	(0.113)
EATR of countries $j \neq i$	0.778^a	0.766^a
$(\bar{t}_{-i,t})$	(0.272)	(0.268)
Top income tax rate	-0.035	-0.068
$(TINC_{it})$	(0.054)	(0.063)
Share of old people	0.154	0.116
(OLD_{it})	(0.689)	(0.736)
Share of young people	-0.183	-0.143
(YOU_{it})	(0.381)	(0.427)
Share of urban people	0.738^b	0.734^b
(URB_{it})	(0.352)	(0.328)
Pub. cons. expenditures	-0.012	0.066
$(PCONS_{i,t-1})$	(0.087)	(0.095)
Market size	0.007	0.006
(ABS_{it})	(0.004)	(0.004)
Market access	0.008	0.008
(MA_{it})	(0.007)	(0.007)
Unemployment rate	-0.045	-0.089
$(UNEMP_{i,t-1})$	(0.101)	(0.107)
GDP growth	-0.006	-0.104
$(GDPGR_{it})$	(0.148)	(0.129)
Government involvement in the wage setting		-0.006^b
$(REG_{i,t})$		(0.003)
Unit labor cost		-0.024
(ULC_{it})		(0.021)
Trend	0.001	0.001
(T_t)	(0.002)	(0.002)
Country fixed effects	yes	yes
Number of observations	224	224
Adjusted R^2	0.801	0.805
Hansen statistic (prob)	0.732	0.884
Serial correlation test (prob)	0.174	0.149
Endogeneity test of $\bar{t}_{-i,t}$ (prob)	0.013	0.005
Endogeneity test of $TINC_{i,t}$ (prob)	0.014	0.007

Notes: Robust standard errors in parentheses. Weigthing matrix based on the bilateral trade phi-ness index W^{PHI}. [a] significant at 10%, [b] significant at 5%, [c] significant at 1%.

Table 4: Estimation of tax interactions over the statutory tax rate

sults of the tax reaction function over statutory tax rates with the weighting matrix based on bilateral trade integration, as it is the only one that passes both the serial correlation test and the test of overidentifying restrictions.

Firsltly, observe that tax interactions are still significant after controlling for the impact of labor market characteristics on corporate tax rates. Taking into account these characteristics slightly improves the regression fit and leads to a decrease in the estimated coefficient of tax interactions[35]. Thus, it seems that not controlling for structural determinants of firms' location choice (market access, market size, or labor market characteristics) might result in an overestimation of fiscal interactions. Observe also that the share of people living in urban areas has a positive impact on statutory tax rates, maybe because of agglomeration economies in cities or because most public goods and services are concentrated in urban areas.

Now let us consider the labor market variables. The variable of unit labor cost has the expected sign but is non significant. This might result from the correlation between this variable and labor productivity, which we expect to have the opposite impact on corporate tax rates. Moreover, the variable of government involvement in the wage setting has a significant and negative effect on statutory tax rates. This result is interesting as it might contribute to explain why corporate tax cuts are sometimes associated with labor market policies aimed at increasing labor market regulation. For example, in 1998, the United Kingdom has introduced a national minimum wage for the first time and, at the same time, decided significant corporate tax cuts. In May 2007, the US Congress approved the first increase in the federal minimum wage in nearly a decade. However, President Bush and Senate Republicans have made business tax breaks a condition for supporting this minimum wage increase, and the two chambers finally accepted tax breaks worth $4.8 billion over 10 years.

To summarize, it seems that labor market imperfections could lead governments to lighten the fiscal burden on firms in order to compensate them for the costs associated to these rigidities.

5 Conclusion

To conclude, we have estimated different reaction functions over the corporate tax rate on a panel of 17 OECD countries between 1982 and 1999. Our results support the tax competition hypothesis as we show that the

[35] Taking into account variables of market size and market access also improves the adjusted R^2.

strongest tax interactions occur between countries that are important trade partners. However, the level of corporate tax rate that can result from this tax competition behavior differs across countries. More precisely, the ability of a country to set a high corporate tax rate increases with its market size and its market access. This might explain why the highest corporate tax rates are observed in G7 countries or in the EU-15. Moreover, the ability of a country to set high corporate tax rates decreases with the degree of governments involvement in the wage-setting. Finally, we show that trade integration matters for the tax policy through two channels: (i) on the one hand trade integration reinforces tax interactions and accelerates the race to the bottom in corporate tax rates, but (ii) on the other hand trade integration makes it possible for countries to set higher corporate tax rates as it improves their market access. We show that the second effect becomes insignificant when we control for the first effect. This indicates that the overall impact of trade integration on corporate tax rates is negative and could explain the negative relationship between trade integration and corporate tax rates that we observed in OECD countries between 1983 and 1999.

Thus, these results might contribute to explain the recent decline in corporate tax rates and its close relationship with the trade integration process, as well as the persistent fiscal disparities between OECD countries. However, as all empirical studies estimating a tax reaction function, we cannot evaluate to which extent tax interactions comes from a tax competition behavior. Indeed, what looks like tax interactions could in fact partly result from a common intellectual trend (Manski, 1993) or from changes in the domestic determinants of corporate taxation (Slemrod, 2004). Moreover, the index of capital mobility used in this empirical study, based on aggregated FDI flows, is inaccurate. An index capturing the mobility of real capital is needed to get more reliable results. Finally, we focused on the potential effect on the fiscal policy of structural determinants related to the market access and labor costs. It would be interesting to go further by controlling for the potential effect of public infrastructures on fiscal policy, since a high corporate tax rate might be partly compensated by the quality of public infrastructures.

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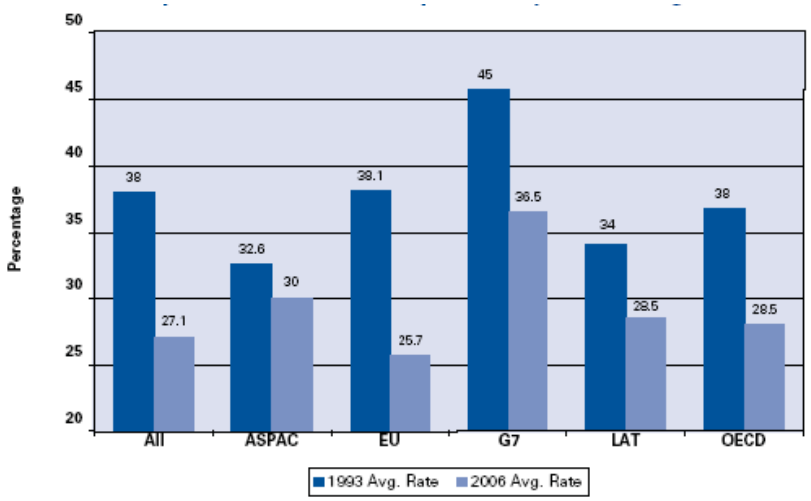
A Appendix

A.1 Corporate tax rate by global region



Source: KPMG International, 2006

A.2 Phiness of trade

In order to approximate the level of trade integration of a country, we build on the Dixit-Stiglitz-Krugman model with many countries and where firms operate on market with monopolistic competition and barriers to trade (Head and Mayer, 2004a). Under the hypotheses of no trade costs at the subnational scale and symmetric trade costs at the international scale, we get from this model the following bilateral index of trade phiness:

$$PHI_{ij} = \sqrt{\frac{X_{ij}X_{ji}}{X_{ii}X_{jj}}}$$

with X_{ij} the total value of exportations (included trade costs) from country i to country j, and X_{ii} the total value of trade flows inside country i. This index is symmetric because of the hypotheses on trade costs.

We use the Trade and Production database of the CEPII that collects trade flows at the ISIC rev2 3-digit industry level (26 industrial sectors) to build a yearly bilateral and sectorial index of trade phiness $PHI_{ijst} = \sqrt{X_{ijst}X_{jist}/X_{iist}X_{jjst}}$, with s the sector in which trade flows occurs. Then, we deduce a bilateral trade phiness index PHI_{ijt} by weighting this sectorial index by the share of importations of country i in this sector:

$$PHI_{ijt} = \sum_{s=1}^{S} \left(PHI_{ijst} \times \frac{X_{jist}}{X_{jit}} \right) \tag{8}$$

with $X_{jist}/X_{jit} = X_{jist}/\sum_s X_{jist}$ the proportion of the importations of country i from country j in the sector s. To finish, we get the index of trade integration associated a country i by weighting this bilateral index by the share of importations of country i from country j, that is:

$$PHI_{it} = \sum_{j=1}^{N} \left(PHI_{ijt} \times \frac{X_{jit}}{X_{it}} \right) \tag{9}$$

with X_{it} total importations of country i at year t and X_{jit}/X_{it} the proportion of importations coming from the country j.

A.3 Market access

The original definition of the market potential by Harris (1954) is given by:

$$MP_{it} = \sum_{j} \frac{Y_{jt}}{dist_{ij}} \tag{10}$$

with Y_{jt} total expenditures coming from countries j and $dist_{ij}$ the distance between country i and j.

We get the market access variable by summing total expenditures of all countries except country i[36]. We take into account only high income countries, according to the classification of the World Bank. Contrary to Harris, we do not approximate trade integration by the inverse of distance between countries. We approximate the level of trade integration by the bilateral index of trade integration given by (8). Finally, we follow Head and Mayer (2004a) by approximating total expenditures of countries by their national apparent consumption. Thus, the market access variable ($MA_{i,t}$) is defined as:

[36] We can also call this variable "non local market potential". It has been used by Mion (2004), Hanson (2005), Mion and Naticchioni (2005), and Redding and Venables (2004) in the estimation of wage equations, in order to limit an endogeneity bias.

$$MA_{it} = \sum_{j \neq i} Abs_{jt} \times PHI_{ijt} \tag{11}$$

A.4 Weigthing matrices

Pair of countries ij	$\omega_{ij,t}^{PHI}$	$\omega_{ij,t}^{FDI}$	$\omega_{ij,t}^{PIBT}$	$\omega_{ij,t}^{PIBTL}$	ω_{ij}^{DIST}
5.	AUT-DEU (0.30)	ESP-SWE (0.21)	AUT-DEU (0.54)	DEU-NOR (0.09)	FIN-SWE (0.26)
4.	FIN-SWE (0.31)	FRA-SWE (0.22)	CAN-AUS (0.64)	AUT-NOR (0.09)	NLD-DEU (0.30)
3.	IRL-GBR (0.34)	IRL-SWE (0.22)	AUS-CAN (0.66)	SWE-NOR (0.09)	DEU-NLD (0.31)
2.	USA-CAN (0.48)	GBR-SWE (0.23)	GBR-FRA (0.95)	JPN-NOR (0.09)	USA-CAN (0.44)
1.	CAN-USA (0.68)	NLD-SWE (0.24)	FRA-GBR (0.95)	USA-NOR (0.09)	CAN-USA (0.44)
Notes: AUT=Austria, DEU=Germany, FIN=Finland, IRL=Ireland, CAN=Canada,GBR=Great Britain, ESP=Spain, SWE=Sweden, NLD=Netherlends, FRA=France, NOR=Norway, JPN=Japan.					

Table 5: Highest weigths with each weigthing matrix

A.5 Results of tax interactions over the statutory tax rate and over the effective marginal tax rate

Dependent variable	**STATTAX**		**EART**		**EMRT**	
Lagged tax rate	0.673^a	0.657^a	0.685^a	0.675^a	0.638^a	0.634^a
$(t_{i,t-1})$	(0.100)	(0.102)	(0.086)	(0.086)	(0.075)	(0.073)
Tax rate of countries $j \neq i$	0.702^a	0.684^a	0.629^b	0.609^b	0.516	0.484
$(\bar{t}_{-i,t})$	(0.267)	(0.262)	(0.291)	(0.293)	(0.369)	(0.406)
Top income tax rate	−0.036	−0.026	0.015	0.020	0.064	0.065
$(TINC_{it})$	(0.057)	(0.055)	(0.040)	(0.041)	(0.041)	(0.043)
Share of old people	0.069	−0.150	−0.198	−0.263	−0.509	−0.516
(OLD_{it})	(0.400)	(0.423)	(0.284)	(0.302)	(0.374)	(0.392)
Share of young people	−0.117	−0.276	−0.023	−0.074	−0.083	−0.100
(YOU_{it})	(0.217)	(0.234)	(0.148)	(0.165)	(0.194)	(0.244)
Share of urban people	0.263	0.219	0.115	0.090	−0.013	−0.017
(URB_{it})	(0.237)	(0.232)	(0.183)	(0.188)	(0.223)	(0.239)
Pub. cons. expenditures	0.017	−0.002	−0.016	−0.023	−0.051	−0.054
$(PCONS_{i,t-1})$	(0.066)	(0.066)	(0.042)	(0.044)	(0.048)	(0.052)
Market size		0.008^c		0.003		0.001
(ABS_{it})		(0.004)		(0.002)		(0.005)
Market access		0.003		0.002		0.005
(MA_{it})		(0.005)		(0.004)		(0.006)
Unemployment rate	−0.046	−0.010	−0.001	0.004	−0.045	−0.044
$(UNEMP_{i,t-1})$	(0.128)	(0.130)	(0.110)	(0.110)	(0.147)	(0.145)
GDP growth	0.028	0.021	0.013	0.012	0.019	0.017
$(GDPGR_{it})$	(0.041)	(0.041)	(0.032)	(0.032)	(0.051)	(0.052)
Trend	0.003^c	0.002	0.002	0.002	0.002	0.001
(T_t)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
Country fixed effects	yes	yes	yes	yes	yes	yes
Number of observations	272	272	272	272	272	272
Adjusted R^2	0.800	0.803	0.794	0.795	0.752	0.752
Hansen statistic (prob)	0.331	0.422	0.538	0.591	0.978	0.999
Serial correlation test (prob)	0.204	0.202	0.300	0.274	0.128	0.114
Endogeneity test of $\bar{t}_{-i,t}$ (prob)	0.041	0.041	0.065	0.065	0.329	0.380
Endogeneity test of $TINC_{i,t}$ (prob)	0.004	0.003	0.013	0.013	0.052	0.056

Notes: Robust standard errors in parentheses. Weigthing matrix based on the bilateral trade phi-ness index W^{PHI}.
[a] significant at 10%, [b] significant at 5%, [c] significant at 1%.

A.6 Data sources and summary statistics

Definitions and data sources

$EATR_{it}$: effective average tax rate (source: Devereux et al. (2002)).

$EMTR_{it}$: effective marginal tax rate (source: Devereux et al. (2002)).

$STATTAX_{it}$: statutory tax rate (source: Devereux et al. (2002)).

$TINC_{it}$: top marginal income tax rate (source: World Tax Database).

ULC_{it} : unit labor cost in manufacturing sector (source: OECD)

PHI_{it} : trade phi-ness index (our calculations, sources: Trade and Production database and the Distances database of the CEPII).

IDE_{it} : sum of inward and outward FDI flows over GDP (our calculations, source: CNUCED and OECD Social Expenditures database).

$PCONS_{it}$: public consumption in percentage of GDP per capita (source: Penn World Table 6.1.).

ABS_{it} : national apparent consumption $\times 10^{-9}$ (our calculations, source: OECD Social Expenditures database et CEPII trade and production database).

MA_{it} : non local market potential $\times 10^{-9}$ (our calculations, sources: Trade and Production database of the CEPII).

$UNEMP_{it}$: standardized unemployment rate (source: OECD Social Expenditures database).

$URB_{i,t}$: proportion of population living in urban areas (source: World Bank Development Indicators).

$OLD_{i,t}$: proportion of population more than 65 years old (source: World Bank Development Indicators).

$YOU_{i,t}$: proportion of population less than 14 years old (source: World Bank Development Indicators).

$GDPGR_{i,t}$: GDP growth rate from year $t-1$ to year t (our calculations, source: OECD Social Expenditures database).

T_t : linear time trend.

REG_{it} : index of government involvement in the wage-setting (source: Golden, Miriam; Peter Lange; and Michael Wallerstein. 2006. "Union Centralization among Advanced Industrial Societies: An Empirical Study." Dataset available at http://www.shelley.polisci.ucla.edu/. Version dated June 16, 2006).

The coding of the index of government involvement in wage-setting is described as follows:

1. Government uninvolved in wage setting.
2. Government establishes minimum wage(s).
3. Government extends collective agreements.

4. Government provides economic forecasts to bargaining partners.

5. Government recommends wage guidelines or norms.

6. Government and unions negotiate wage guidelines.

7. Government imposes wage controls in selected industries.

8. Government imposes cost of living adjustment.

9. Formal tripartite agreement for national wage schedule without sanctions.

10. Formal tripartite agreement for national wage schedule with sanctions.

11. Government arbitrator imposes wage schedules without sanctions on unions.

12. Government arbitrator imposes national wage schedule with sanctions.

13. Government imposes national wage schedule with sanctions.

14. Formal tripartite agreement for national wage schedule with supplementary

local bargaining prohibited.

15. Government imposes wage freeze and prohibits supplementary local bargaining.

Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.
$STATTAX_{it}$	0.410	0.122	0.100	0.627
$EATR_{it}$	0.305	0.090	0.050	0.481
$EMTR_{it}$	0.256	0.100	0.000	0.478
FDI_{it}	0.032	0.040	−0.003	0.330
PHI_{it}	0.053	0.035	0.007	0.222
$OPEN_{it}$	0.541	0.277	0.134	1.636
OLD_{it}	0.139	0.021	0.098	0.180
URB_{it}	0.705	0.105	0.443	0.893
YOU_{it}	0.196	0.029	0.144	0.303
$PCONS_{it}$	0.112	0.057	0.031	0.269
MA_{it}	0.521	0.469	0.065	3.367
ABS_{it}	0.959	1.608	0.024	9.351
REG_{it}	5.239	3.007	1	15
ULC_{it}	0.635	0.207	0.2	1.2

Table 7: Summary statistics